EPIC Geolocation Quality Summary

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1 EPIC QUALITY SUMMARY

This is a brief summary of known algorithm and software implementation issues in the EPIC L1A/B geolocation. For more information regarding the geolocation algorithm, please refer to the "EPIC Geolocation and Color Imagery" document.

2 GEOLOCATION ERROR

The current version of the geolocation has been optimized for relative geolocation, the correlation between the different bands. Further version will focus on improving the absolute geolocation, the relationship between the pixels and their physical locations. These include atmospheric refraction, improved optical model, and timing corrections.

The below paragraph has been supplied by Dr. Lyapustin's group.

The geolocation error is characterized by matching the ground reference points identified in both EPIC and MODerate resolution Imaging Spectroradiometer (MODIS) images. Ground reference points are selected as the coastlines where there are no clouds. Geolocation error is generally within two EPIC pixels around the center of the image and tends to increase when moving away from the center. It is found that the geolocation error can reach up to 50 km at the boundaries of EPIC images. Users should use the data with caution when performing time-series analysis or developing algorithms that require aligning EPIC images with other data sources (e.g., land cover map, Digital Elevation Map). The geolocation error is relatively smooth in space and therefore it is possible to simply translate the EPIC image to minimize the geolocation error if the area of interest is not large (< 1000 km).

3 ATMOSPHERIC REFRACTION

Correction for atmospheric refraction is not included in this version of geolocation. This results in an error in the calculation of the altitude across the Earth that is relatively small near 90 degrees and increases to the outer ranges of the disk. The effect on latitude and longitude is a spatial compression at larger view angles. The error is estimated to be

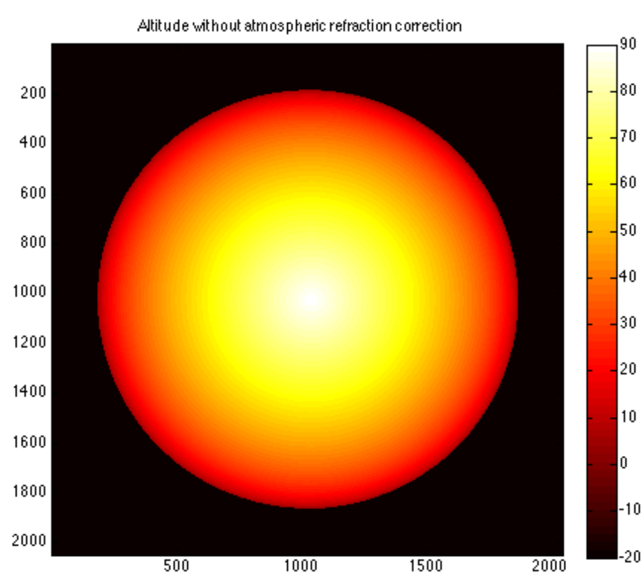

Figure 1 - Uncorrected viewing altitude in degrees across the Earth's disk

approximately 150km at 60 degree view zenith angle.

Figure 1 shows the uncorrected altitude angles and figure 2, the estimate of the difference in actual angle due to refraction. The estimated refraction calculation was done using the simplified Saemundsson formula for yellow light. The correct ion for EPIC is more complicated, requiring accuracy across a wider set of angles and wavelengths. It is anticipated that this correction will be available in the next version of the geolocation algorithm.

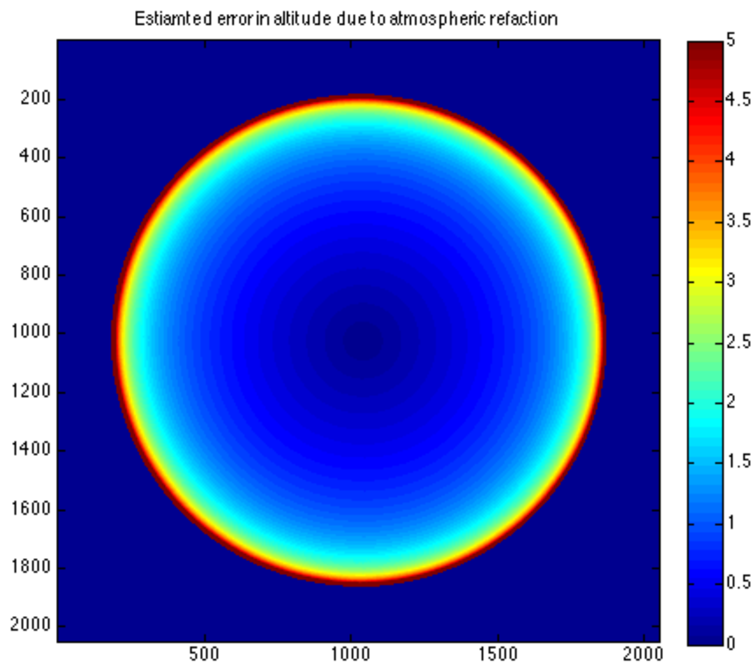

Figure 2 - Estimated difference due to atmospheric refraction, in minutes of arc

4 OPTICAL ERROR

There are some issues with the optical model that contribute to inaccuracies in determining how the object being imaged is projected onto the CCD. The mechanics of this issue are still being defined.

5 SAMPLING ARTIFACT

The geolocation generates a high resolution 3D model of the Earth latitude, longitude, and sun/view angles. The process of sampling this model to create the 2D datasets creates a sampling artifact known as “aliasing”. The appearance of this artifact is a seemingly random noise in the delta of the values created. The noise is actually not random and its underlying structure is a moiré pattern. An example can be seen in figure 3.

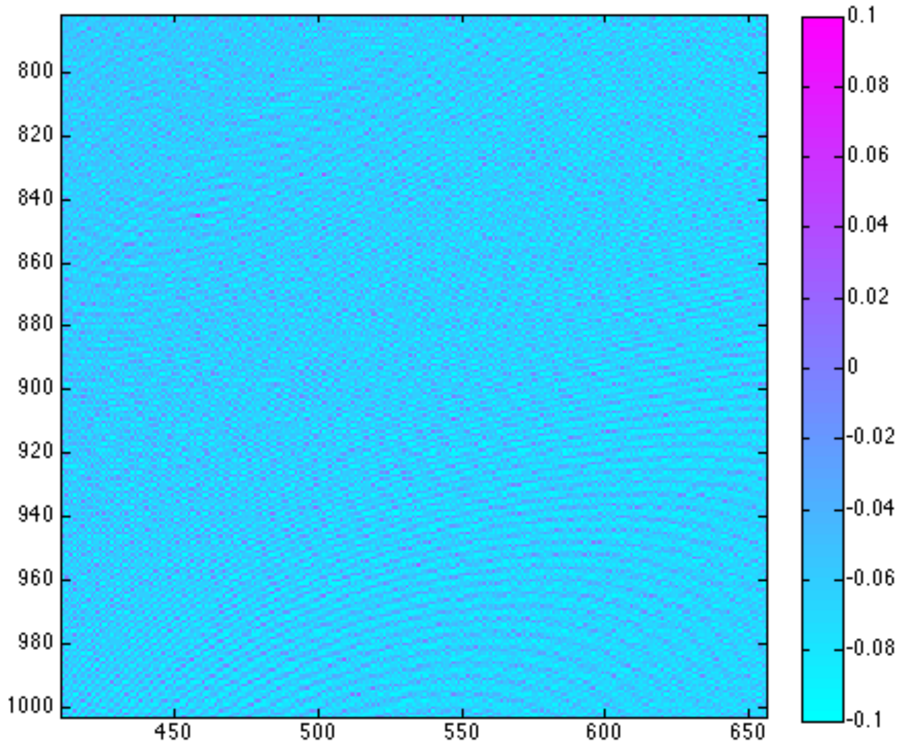

Figure 3 - Zoomed-in example of moiré pattern from the difference of the latitude

6 CENTROIDING

EPIC imagery requires an Earth centering step known as “centroiding”. During centroiding, an x, y offset is calculated for translating the Earth to the center of the image. For more details, consult the EPIC geolocation algorithm document.
Accuracy of centroiding in the L1A is on average +/- 1 pixel or less, although the error occasionally can be greater in some situations. Additional registration is done in the L1B to compensate for this by using a statistical correlation algorithm.
It is anticipated that the addition of the stray light correction in future L1A products will improve the centroiding process.

7 L1A DISCONTINUITY AT -180/180 ISSUE

There are occasionally discontinuities at the -180/180 mark in the L1A product due to a bug in the EPIC model optical correction software. This problem is not in the L1B. There is a fix in place and this problem will not be present in future products.

8 GEOLOCATION WITH MOON

The Moon is occasionally imaged for calibration purposes. In these situations, the geolocation will run and produce an L1A dataset. No L1B will be produced. The L1A product does contain latitude and longitudes, but the accuracy for these products are very coarse and unvetted.

9 NO L1A/B PRODUCTS WHEN EARTH AND MOON ARE IN VIEW

The geolocation software will not product a L1A or L1B product when both the Earth and Moon are in view. This is due to the object centering algorithm (centroiding) being able to handle only one object in the field of view. The color images released during these events are produced using a special imaging sequence to limit effect of Earth's rotation, plus a manual centering and a special statistics-based band registration process.